(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 329 981 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
23.07.2003 Bulletin 2003/30

(51) Int Cl.[7]: **H01Q 1/24**, H01Q 1/08, H04B 1/38

(21) Application number: **03001202.5**

(22) Date of filing: **17.01.2003**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IT LI LU MC NL PT SE SI SK TR
Designated Extension States:
AL LT LV MK RO

(30) Priority: **18.01.2002 KR 2002002934**

(71) Applicant: **SAMSUNG ELECTRONICS CO., LTD.**
Suwon-City, Kyungki-do (KR)

(72) Inventor: **Kim, Young-Jin**
Paldal-gu, Suwon-city, Kyungki-do (KR)

(74) Representative: **Lang, Johannes, Dipl.-Ing. et al**
Bardehle Pagenberg Dost Altenburg Geissler Isenbruck,
Postfach 86 06 20
81633 München (DE)

(54) Antenna unit using helical hinge spring

(57) Disclosed is an antenna unit using a helical hinge spring which is used for a portable terminal including (A) a main housing, (B) a sub housing, and (C) a hinge module rotatably opening and closing the sub housing from and into the main housing and including a hinge shaft having one end attached to the main housing and the other end positioned within the sub housing and serving to interconnect the main housing and the sub housing, a hinge cam being slid by the hinge shaft and moving forward and backward, the helical hinge spring for providing a force for closely adhering the hinge shaft to the hinge cam, and a hinge housing for accommodating the hinge shaft, the hinge cam, and the helical hinge spring, the antenna unit comprising: (a) the helical hinge spring disposed in a direction of a hinge axis and serving as a helical antenna; (b) a conductive member including a contact portion disposed between the helical hinge spring and the hinge cam and closely adhered to the helical hinge spring, and a center portion extending from a center of the contact portion in the direction of the hinge axis and passing through the hinge cam and the hinge shaft; and (c) a plate spring with a first free terminal connected to the conductive member and a second free terminal connected to a power-feeding portion.

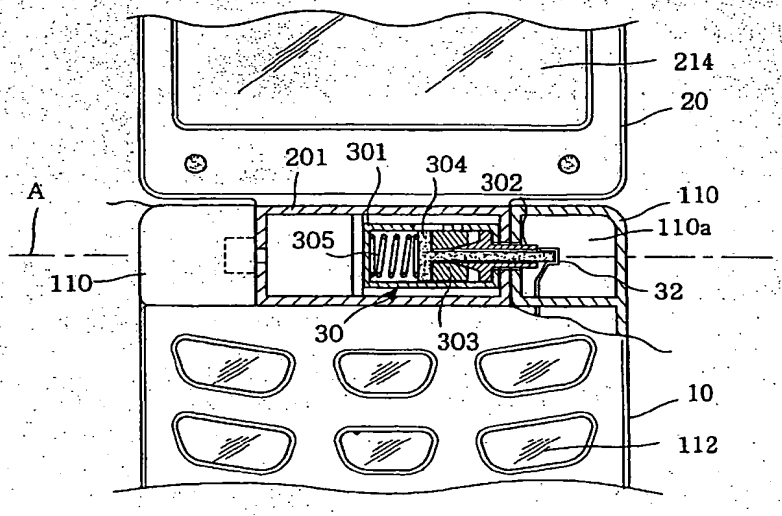


FIG.3

EP 1 329 981 A2

Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to an antenna unit of a portable terminal, and more particularly to an antenna unit using a helical hinge spring installed on the hinge module.

2. Description of the Related Art

[0002] Usually, a portable terminal refers to a portable unit for communicating with a counterpart via wireless communication with a base station. These portable terminals are divided into several types, e.g., bar-type terminals, flip-type terminals, folder-type terminals, flip up-type terminals, and folder-type terminals for being also used as a PDA, according to their shape. Further, the portable telephone terminals may be divided into telephone terminals for voice communication, telephone terminals for picture communication, telephone terminals for Internet communication, telephone terminals for Internet gaming, and telephone terminals for chatting, according to their function. Moreover, the portable telephone terminals may be divided into necklace types, wristlet types, and pocket-sized types, according to their wearing locations.

[0003] Each of the aforementioned individual portable terminals essentially comprises an antenna unit, a data input/output unit, and a data transmitting/receiving unit to facilitate communication with the counterpart. As the usually used data input unit, a keypad or a touch sensitive panel is employed. The keypad comprises an array of a plurality of keys for inputting data by a pressing action. The touch sensitive panel serves to input data by a touching action. Further, a display such as a LCD (Liquid Crystal Display) module is also commonly used as the data output unit. A microphone unit is used as the data transmitting unit and a speaker unit is used as the data receiving unit.

[0004] Portable terminals having multiple functionality and that are suitable for various multimedia environments are being spotlighted and popularized.

[0005] In order to transmit/receive radio waves, conventional portable terminals essentially comprises an antenna, a power-feeding portion, and an RF (Radio Frequency) unit. The conventional antennas of the portable terminal are divided into two types, i.e., an internal type and an external type. The internal type antenna is installed within a main housing of the portable terminal. The external type antenna protrudes from the main housing of the portable terminal and is exposed to the outside. As the conventional antenna, a helical antenna or a whip antenna is usually employed. Herein, the helical antenna serves as a main antenna and the whip antenna serves as an auxiliary antenna.

[0006] However, in case of using an internal type antenna installed on a designated area of a printed circuit board within the main housing of the portable terminal, the portable terminal requires an internal space for accommodating the internal type antenna, making it difficult to effectively utilize the limited space available within the main body of the portable terminal. That is, the portable terminal using the internal antenna has a drawback of increasing the size of the printed circuit board.

[0007] On the other hand, the external type antenna protrudes from the main body of the portable terminal, thereby limiting the external design of the portable terminal. Further, when the portable terminal falls to the ground due to the user's carelessness, the external type antenna is easily broken. Since the external antenna of the portable telephone terminal protrudes from the main body housing, this protruded external antenna of the portable terminal is easily damaged.

SUMMARY OF THE INVENTION

[0008] Therefore, the present invention has been made in view of the above problems, and it is an object of the present invention to provide an antenna unit using a hinge spring, thereby maintaining antenna characteristics and not requiring a further space for accommodating the antenna unit.

[0009] It is another object of the present invention to provide an antenna unit using a hinge spring, which satisfies a miniaturization trend.

[0010] In is yet another of the present invention to provide an antenna unit using a hinge spring, which can be used as an auxiliary antenna.

[0011] In accordance with one aspect of the present invention, the above and other objects can be accomplished by the provision of an antenna unit using a helical hinge spring which is used in a portable terminal including (A) a main housing, (B) a sub housing, and (C) a hinge module rotatably opening and closing the sub housing from and into the main housing and including a hinge shaft having one end fixedly attached to the main housing and the other end positioned within the sub housing and serving to interconnect the main housing and the sub housing, a hinge cam being slid by the hinge shaft and moving forward and backward, the helical hinge spring for providing a force for closely adhering the hinge shaft to the hinge cam, and a hinge housing for accommodating the hinge shaft, the hinge cam, and the helical hinge spring, the antenna unit comprising: (a) the helical hinge spring disposed in a direction of a hinge axis and serving as a helical antenna; (b) a conductive member including a contact portion disposed between the helical hinge spring and the hinge cam and closely adhered to the hinge spring, and a center portion extending from a center of the contact portion in the direction of the hinge axis and passing through the hinge cam and the hinge shaft; and (c) a plate spring with a first free terminal connected to the conductive member and

a second free terminal connected to a power-feeding portion.

[0012] In accordance with another aspect of the present invention, there is provided to an antenna unit using a helical hinge spring which is used in a portable terminal including (A) a main housing, (B) a sub housing, and (C) a hinge receptor rotatably opening and closing the sub housing from and into the main housing and including a hinge shaft having one end fixedly attached to the main housing and the other end positioned within the sub housing and serving to interconnect the main housing and the sub housing, a hinge cam being slid by the hinge shaft and moving forward and backward, and the helical hinge spring for providing a force for closely adhering the hinge shaft to the hinge cam, the antenna unit comprising: (a) the helical hinge spring disposed in a direction of a hinge axis and serving as a helical antenna; (b) a conductive member including a contact portion closely adhered to the helical hinge spring, and a center portion extending from a center of the contact portion in the direction of the hinge axis and passing through the hinge spring, the hinge cam and the hinge shaft; and (c) a plate spring with a first free terminal connected to the conductive member and a second free terminal connected to a power-feeding portion.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] The above and other objects, features and other advantages of the present invention will be more clearly understood from the following detailed description taken in conjunction with the accompanying drawings, in which:

Fig. 1 is a perspective view of a portable terminal in which a sub housing is closed;

Fig. 2 is a perspective view of the portable terminal in which the sub housing is open;

Fig. 3 is a partial cut-away plan view of the portable terminal in which the sub housing is open, showing in cut-away an antenna unit using a helical hinge spring in accordance with the first preferred embodiment of the present invention;

Fig. 4 is a partially exploded plan view of the antenna unit using the helical hinge spring in accordance with the first embodiment of the present invention;

Fig. 5 is a cross-sectional view of the antenna unit of Fig. 4;

Fig. 6 is a partially exploded plan view of an antenna unit using a helical hinge spring in accordance with a second preferred embodiment of the present invention;

Fig. 7 is a cross-sectional view of the antenna unit of Fig. 6;

Fig. 8a is a graph showing a radiation pattern illustrating the antenna characteristics of a conventional antenna unit using a helical antenna at Korean PCS band (1,750~1,870MHz) in an open status of a sub housing; Fig. 8b is a graph showing a radiation pattern illustrating the antenna characteristics of the conventional antenna unit using the helical antenna at Korean PCS band (1,750~1,870MHz) in a closed status of the sub housing; Fig. 9a is a graph showing a radiation pattern illustrating the antenna characteristics of the antenna unit using the helical hinge spring at Korean PCS band (1,750~1,870MHz) in an open status of a sub housing in accordance with the first embodiment of the present invention; Fig. 9b is a graph showing a radiation pattern illustrating the antenna characteristics of the antenna unit using the helical hinge spring at Korean PCS band (1,750~1,870MHz) in a closed status of the sub housing in accordance with the first embodiment of the present invention;

Fig. 10a is a graph showing a radiation pattern illustrating the antenna characteristics of a conventional chip type antenna at BT (Blue Tooth) band (2,400~2,483MHz) in an open status of a sub housing; Fig. 10b is a graph showing a radiation pattern illustrating the antenna characteristics of the conventional chip type antenna at BT (Blue Tooth) band (2,400~2,483MHz) in a closed status of the sub housing; Fig. 11a is a graph showing a radiation pattern illustrating the antenna characteristics of the antenna unit using the helical hinge spring at BT (Blue Tooth) band (2,400~2,483MHz) in an open status of a sub housing in accordance with the first embodiment of the present invention; and Fig. 11b is a graph showing a radiation pattern illustrating the antenna characteristics of the antenna unit using the helical hinge spring at BT (Blue Tooth) band (2,400~2,483MHz) in a closed status of the sub housing in accordance with the first embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0014] Now, preferred embodiments of the present invention will be described in detail with reference to the annexed drawings. In the drawings, the same or similar elements are denoted by the same reference numerals even though they are depicted in different drawings. In the following description, a detailed description of known functions and configurations is omitted to avoid making the subject matter of the present invention unclear.

[0015] Fig. 1 is a perspective view of a portable terminal in which a sub housing is closed, and Fig. 2 is a perspective view of the portable terminal in which the sub housing is open. The portable terminal of Figs. 1 and 2also comprises an antenna unit (shown in Fig. 3) using a helical hinge spring in accordance with the first preferred embodiment of the present invention. The portable terminal comprises a main housing 10, a sub housing 20, and a hinge unit. The hinge unit rotatably

connects the sub housing 20 to the main housing 10, thereby opening and closing the sub housing 20 from and into the main housing 10. That is, the sub housing 20 rotatably moves on a rotation axis A within a designated angle. The main housing 10 comprises a key array consisting of a plurality of keys 112, and a microphone unit 114. The sub housing 20 comprises a speaker unit 212 and a LCD 214.

[0016] The main housing 10 includes two side hinge arms 110. One side hinge arm 110 is symmetrically opposite to the other side hinge arm 110. The sub housing 20 includes a center hinge arm 201. The center hinge arm 201 of the sub housing 20 is held between the two side hinge arms 110 of the main housing 10 by the hinge unit.

[0017] As shown in Fig. 3, a hinge module 30 applied to the portable terminal functions first to rotatably connect the sub housing 20 to the main housing 10 and secondarily to provide a force for closing the sub housing 20 within a first range of designated angles (0°~45°), provide a force for opening the sub housing 20 in a second range of more than the first range of designated angles (45°~140°), and provide a force for stopping the motion of the sub housing 20 at another third designated angle (140°). That is, the hinge module 30 of the portable terminal provides a user with a force for easily opening and closing the sub housing 20 from and into the main housing 10. Therefore, the hinge module 30 essentially comprises a hinge shaft 302, a hinge cam 303, and a helical hinge spring 305. Further, a hinge housing 301 may be used to separately assemble the hinge shaft 302, the hinge cam 303, and the helical hinge spring 305 of the hinge module 30.

[0018] The hinge module 30 of the first preferred embodiment of the present invention, particularly the helical hinge spring 305 is used as the antenna unit. Fig. 3 shows the antenna unit using the helical hinge spring 305 of the hinge module 30 in accordance with the first embodiment of the present invention.

[0019] As shown in Fig. 3, the antenna unit of the first embodiment of the present invention comprises the hinge module 30, more particularly the helical hinge spring 305 accommodated within the hinge housing 301, a conductive member 304, and a plate spring 32 located within internal space 110a of side hinge arm 110. The conductive member 304 is accommodated within the hinge housing 301 so as to electrically connect the helical hinge spring 305 to a power-feeding portion (not shown). The plate spring 32 is closely adhered to the conductive member 304, thereby electrically connecting the conductive member 304 to the power-feeding portion.

[0020] Fig. 4 is a partially exploded plan view of the antenna unit using the helical hinge spring in accordance with the first preferred embodiment of the present invention, and Fig. 5 is a cross-sectional view of the antenna unit of Fig. 4. Hereinafter, with reference to Figs. 4 and 5, the antenna unit of the first preferred embodiment of the present invention is described in detail.

[0021] As shown in Figs. 4 and 5, the antenna unit of the first embodiment of the present invention utilizes the hinge module 30. In order to supply a force for opening and closing the sub housing, the hinge module comprises the hinge housing 301, the hinge shaft 302, the hinge cam 303, and the helical hinge spring 305. The antenna unit of the first embodiment of the present invention is embodied using the helical hinge spring 305 installed on the hinge module and the conductive member 304 separate from the helical hinge spring 305.

[0022] The hinge housing 301 is installed on the center hinge arm 201 of the sub housing 20, and accommodates the hinge shaft 302, the hinge cam 303, the conductive member 304, and the helical hinge spring 305. One end 302a of the hinge shaft 302 is engaged with the side hinge arm 110 of the main housing 10 and the other end 302b of the hinge shaft 302 is a convex portion. Further, a through hole 302c is formed in the hinge shaft 302 along the hinge axis. The hinge shaft 302 is fixedly attached to the side hinge arm 110. Therefore, as the sub housing 20 is opened and closed from and into the main housing 10, the hinge cam 303 slides due to its engagement with convex portion 302b of hinge shaft 302.

[0023] The hinge cam 303 includes convex portion 303a and a concave portion 303b. A protrusion 303d is formed on the outer circumference of the hinge cam 303; the protrusion 303d guides the hinge cam 303 forward and backward within the hinge housing 301. The hinge cam 303 is slid by the hinge shaft 302, and thereby moves forward and backward along the length direction of the hinge housing 301. A through hole 303c is formed in the hinge cam 303 along the hinge axis.

[0024] The conductive member 304 includes a contact portion 304a disposed between the hinge cam 303 and the helical hinge spring 305 and being in contact with one end 305a of the helical hinge spring 305, and a center portion 304b being inserted into the through hole 303c of the hinge cam 303 and the through hole 302c of the hinge shaft 302. A terminal 304c of the center portion 304b of the conductive member 304 has a designated length so as to protrude from the surface of the hinge shaft 302. The diameter of the center portion 304b of the conductive member 304 is smaller than that of the through holes 302c and 303c. Therefore, the conductive member 304 is not influenced by the straight-line motion of the hinge shaft 302 or the hinge cam 303.

[0025] The helical hinge spring 305 is disposed between the hinge housing 301 and the conductive member 304. One end 305a of the helical hinge spring 305 is always in contact with the contact portion 304a of the conductive member 304, thereby functioning to closely adhere the hinge shaft 302 to the hinge cam 303.

[0026] The plate spring 32 is made of a conductive material with elasticity. The plate spring 32 includes two free terminals, i.e., a first free terminal 321 and a second free terminal 322. The first free terminal 321 of the plate

spring 32 is bent to be connected to the terminal 304c of the center portion 304b of the conductive member 304, and the second free terminal 322 of the plate spring 32 is connected to the power-feeding portion of a main printed circuit board (not shown). Herein, the first free terminal 321 of the plate spring 32 is closely adhered to the terminal 304c of the conductive member 304 by an elastic force of the plate spring 32.

[0027] When the sub housing is opened and closed from and into the main housing, the hinge shaft 302 is bound by one of the side hinge arms 110, and the hinge cam 303 moves forward and backward by the hinge shaft 302. Then, the helical hinge spring 305 is compressed and then extends. Further, the conductive member 304 is maintained in close adherence with the hinge spring 305. Therefore, the helical hinge spring 305 is always electrically connected to the plate spring 32 by the conductive member 304, and is connected to the power-feeding portion via the plate spring 32.

[0028] Fig. 6 is a partially exploded plan view of an antenna unit using a helical hinge spring in accordance with a second preferred embodiment of the present invention, and Fig. 7 is a cross-sectional view of the antenna unit of Fig. 6. Hereinafter, with reference to Figs. 6 and 7, the antenna unit using the helical hinge spring 403 of the second preferred embodiment of the present invention is described in detail. As shown in Figs. 6 and 7, the antenna unit using the helical hinge spring 403 of the second embodiment of the present invention utilizes a hinge module 40. In order to supply a force for opening and closing the sub housing, the hinge module 40 serving as the hinge means of the portable terminal comprises a hinge shaft 401, a hinge cam 402, and the helical hinge spring 403. The antenna unit of the second embodiment of the present invention is embodied using the helical hinge spring 403 installed on the hinge module 40 and a conductive member 404.

[0029] The hinge shaft 401, the hinge cam 402, the conductive member 404, and the helical hinge spring 403 are accommodated within a hinge receptor 405 installed within the center hinge arm 201 of the sub housing 20. One end 401a of the hinge shaft 401 protrudes from the hinge receptor and the other end 401b of the hinge shaft 401 is a convex portion. A through hole 401c is formed in the hinge shaft 401 along the hinge axis.

[0030] The hinge cam 402 includes a convex portion 402a and a concave portion 402b. A protrusion 402c is formed on the outer circumference of the hinge cam 402, thereby moving the hinge cam 402 forward and backward within the hinge receptor. The hinge cam 402 is slid by the hinge shaft 401, thereby moving forward and backward along the length direction of the hinge receptor 405. A through hole 402d is formed in the hinge cam 402 along the hinge axis.

[0031] The conductive member 404 includes a contact portion 404a disposed between one end 403b of the helical hinge spring 403 and a separation wall of the hinge receptor 405 and being in contact with the end 403b of the helical hinge spring 403, and a center portion 404b disposed within the helical hinge spring 403 and inserted into the through hole 402d of the hinge cam 402 and the through hole 401c of the hinge shaft 401. A terminal 404c of the center portion 404b of the conductive terminal 404 has a designated length so as to protrude from the surface of the hinge shaft 401. The diameter of the center portion 404b of the conductive member 404 is smaller than that of the through holes 401c and 402d. Therefore, the conductive member 404 is not influenced by the straight-line motion of the hinge shaft 401 and the hinge cam 402.

[0032] The helical hinge spring 403 is disposed between the hinge shaft 401 and the conductive member 404. One end 403b of the helical hinge spring 403 is always in contact with the contact portion 404a of the conductive member 404, thereby functioning to closely adhere the hinge shaft 401 to the hinge cam 402.

[0033] A plate spring 42 is made of a conductive material. The plate spring 42 includes two free terminals, i. e., a first free terminal 421 and a second free terminal 422. The first free terminal 421 of the plate spring 42 is bent to be connected to the terminal 404c of the center portion 404b of the conductive member 404, and the second free terminal 422 of the plate spring 42 is connected to the power-feeding portion (not shown). Herein, the first free terminal 421 of the plate spring 42 is closely adhered to the terminal 404c of the conductive member 404 by an elastic force of the plate spring 42.

[0034] When the sub housing is opened and closed from and into the main housing, the hinge shaft 401 is bound by one of the side hinge arms 110, and the hinge cam 402 moves forward and backward over the convex portion 401b of the hinge shaft 401. Then, the helical hinge spring 403 is compressed and expanded. Further, the hinge spring 403 is maintained to be in close adherence with the contact portion 404a of the conductive member 404. Therefore, the helical hinge spring 403 is always electrically connected to the plate spring 42 by the conductive member 404, and is electrically connected to the power-feeding portion via the plate spring 42.

[0035] Hereinafter, with reference to Figs. 8a to 11b, the antenna characteristics of the antenna unit using the helical hinge spring in accordance with the first embodiment of the present invention is described in comparison with the conventional antenna unit.

[0036] Fig. 8a is a graph showing a radiation pattern illustrating the antenna characteristics of a conventional antenna unit using a helical antenna at Korean PCS band (1,750~1,870MHz) in an open status of a sub housing, and Fig. 8b is a graph showing a radiation pattern illustrating the antenna characteristics of the conventional antenna unit using the helical antenna at Korean PCS band (1,750~1,870MHz) in a closed status of the sub housing.

[0037] Fig. 9a is a graph showing a radiation pattern illustrating the antenna characteristics of the antenna

unit using the helical hinge spring at Korean PCS band (1,750~1,870MHz) in an open status of a sub housing in accordance with the first embodiment of the present invention, and Fig. 9b is a graph showing a radiation pattern illustrating the antenna characteristics of the antenna unit using the helical hinge spring at Korean PCS band (1,750~1,870MHz) in a closed status of the sub housing in accordance with the first embodiment of the present invention.

[0038] As shown in Figs. 8a to 9b, a peak gain and a gain of a +90 direction of the antenna unit using the helical hinge spring of the first embodiment of the present invention in the closed status of the sub housing are a little lower than those of the conventional antenna unit. However, those gains of the antenna unit using the helical hinge spring of the first embodiment of the present invention in the open status of the sub housing are higher than those of the conventional antenna unit.

[0039] Fig. 10a is a graph showing a radiation pattern illustrating the antenna characteristics of the conventional chip type antenna at BT (Blue Tooth) band (2,400~2,483MHz) in an open status of a sub housing, and Fig. 10b is a graph showing a radiation pattern illustrating the antenna characteristics of the conventional chip type antenna at BT (Blue Tooth) band (2,400~2,483MHz) in a closed status of the sub housing.

[0040] Fig. 11a is a graph showing a radiation pattern illustrating the antenna characteristics of the antenna unit using the helical hinge spring at BT (Blue Tooth) band (2,400~2,483MHz) in an open status of a sub housing in accordance with the first embodiment of the present invention, and Fig. 11b is a graph showing a radiation pattern illustrating the antenna characteristics of the antenna unit using the helical hinge spring at BT (Blue Tooth) band (2,400~2,483MHz) in a closed status of the sub housing in accordance with the first embodiment of the present invention.

[0041] As shown in Figs. 10a to 11b, the peak gain and an average gain of the antenna unit using the helical hinge spring of the first embodiment of the present invention in the open and closed status of the sub housing are higher than those of the conventional antenna unit. The helical hinge spring of the present invention has a diameter of approximately 4.3mm and a length of approximately 9.5mm. Therefore, if the helical hinge spring has a greater diameter and length using a bigger hinge module, an antenna unit with further improved antenna characteristics can be obtained.

[0042] Additionally, the helical hinge spring of the present invention is designed to satisfy the antenna characteristics by adjusting the diameter and the length of the helical hinge spring, thereby being used as various kinds of antennas.

[0043] Consequently, the antenna unit using helical hinge spring of the present invention can be substituted for the conventional antenna at Korean PCS band or BT (Blue Tooth) band. Therefore, the antenna unit of the present invention satisfies the miniaturization of the main body of the portable terminal, improves a portable function of the portable terminal, and allows more flexible designing of an external appearance of the portable terminal.

[0044] For example, as the hinge module is enlarged by the increase of the size of the main body of the terminal, the length and/or diameter of the helical hinge spring may also be increased, thereby improving the antenna gain by the helical hinge spring.

[0045] As apparent from the above description, according to the present invention, the antenna unit is obtained using a hinge module, thereby allowing more flexible designing of an external appearance of the portable terminal using the antenna and reducing the production cost of the antenna. Further, the present invention does not require an internal space for accommodating an additional antenna, thereby maximizing space utilization and satisfying a lightweight trend. Moreover, the antenna unit of the present invention can be used as a supplementary antenna of a dual band terminal operated at a combined band of PCS, CDMA, AMPS, GSM, GPS, BT (blue tooth), and so on, and as a diversity antenna for increasing the data speed of a terminal requiring a super high-speed data communication such as a HDR.

[0046] Although the preferred embodiments of the present invention have been disclosed for illustrative purposes, those skilled in the art will appreciate that various modifications, additions and substitutions are possible, without departing from the scope and spirit of the invention as disclosed in the accompanying claims.

Claims

1. An antenna unit using a helical hinge spring which is used in a portable terminal including (A) a main housing, (B) a sub housing, and (C) a hinge module rotatably opening and closing the sub housing from and into the main housing and including a hinge shaft having one end fixedly attached to the main housing and the other end positioned within the sub housing and serving to interconnect the main housing and the sub housing, a hinge cam being slid by the hinge shaft and moving forward and backward, the helical hinge spring providing a force for closely adhering the hinge shaft to the hinge cam, and a hinge housing for accommodating the hinge shaft, the hinge cam, and the helical hinge spring, said antenna unit comprising:

   (a) the helical hinge spring disposed in a direction of a hinge axis and serving as a helical antenna; and

   (b) a conductive member including a contact portion disposed between the helical hinge spring and the hinge cam and closely adhered to the helical hinge spring, and a center portion

extending from a center of the contact portion in the direction of the hinge axis and passing through the hinge cam and the hinge shaft.

2. The antenna unit of claim 1, further comprising a plate spring with a first free terminal connected to the conductive member and a second free terminal connected to a power-feeding portion.

3. The antenna unit of claim 1, wherein the hinge shaft comprises a first through hole along the hinge axis and the hinge cam comprises a second through hole along the hinge axis so that the center portion of the conductive member passes through the first and second through holes.

4. The antenna unit of claim 3, wherein the diameter of the first and second through holes is greater than that of the center portion of the conductive member.

5. The antenna unit of claim 1, wherein a terminal of the center portion of the conductive member protrudes from the hinge shaft.

6. The antenna unit of claim 2, wherein the first free terminal of the plate spring is closely adhered to a terminal of the center portion of the conductive member by an elastic force of the plate spring.

7. An antenna unit using a helical hinge spring which is used in a portable terminal including (A) a main housing, (B) a sub housing, and (C) a hinge receptor rotatably opening and closing the sub housing from and into the main housing and including a hinge shaft having one end fixedly attached to the main housing and the other end positioned within the sub housing and serving to interconnect the main housing and the sub housing, a hinge cam being slid by the hinge shaft and moving forward and backward, and the helical hinge spring providing a force for closely adhering the hinge shaft to the hinge cam, said antenna unit comprising:

(a) the helical hinge spring disposed in a direction of a hinge axis and serving as a helical antenna; and
(b) a conductive member including a contact portion closely adhered to the helical hinge spring, and a center portion extending from a center of the contact portion in the direction of the hinge axis and passing through the the helical hinge spring, the hinge cam and the hinge shaft.

8. The antenna unit of claim 7, further comprising a plate spring with a first free terminal connected to the conductive member and a second free terminal connected to a power-feeding portion.

9. The antenna unit of claim 7, wherein the hinge shaft comprises a first through hole along the hinge axis and the hinge cam comprises a second through hole along the hinge axis so that the center portion of the conductive member passes through the first and second through holes.

10. The antenna unit of claim 9, wherein the diameter of the first and second through holes is greater than that of the center portion of the conductive member.

11. The antenna unit of claim 7, wherein a terminal of the center portion of the conductive member protrudes from the hinge shaft.

12. The antenna unit of claim 8, wherein the first free terminal of the plate spring is closely adhered to a terminal of the center portion of the conductive member by an elastic force of the plate spring.

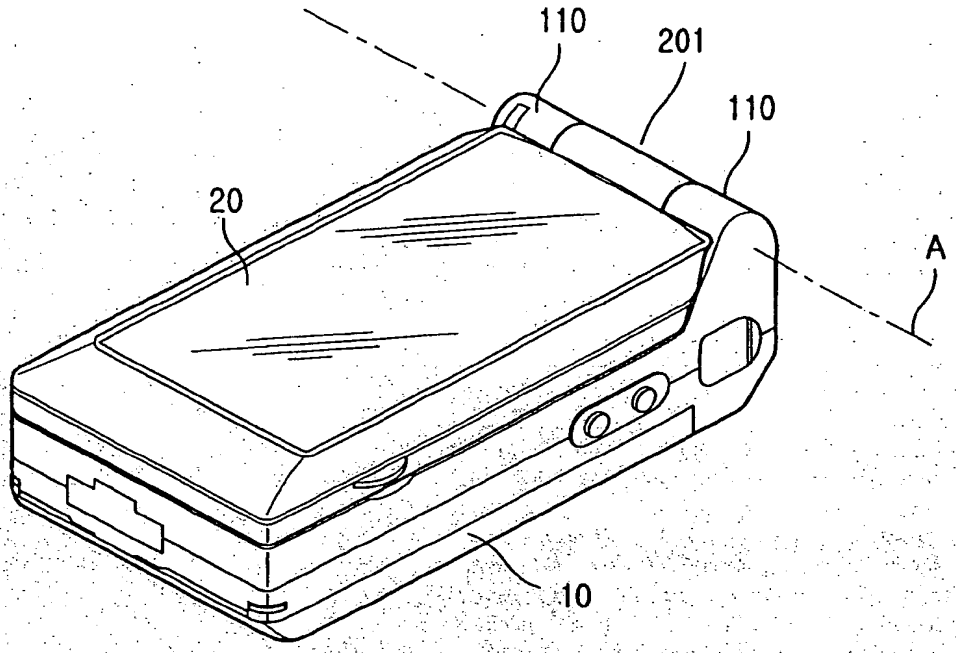


FIG.1

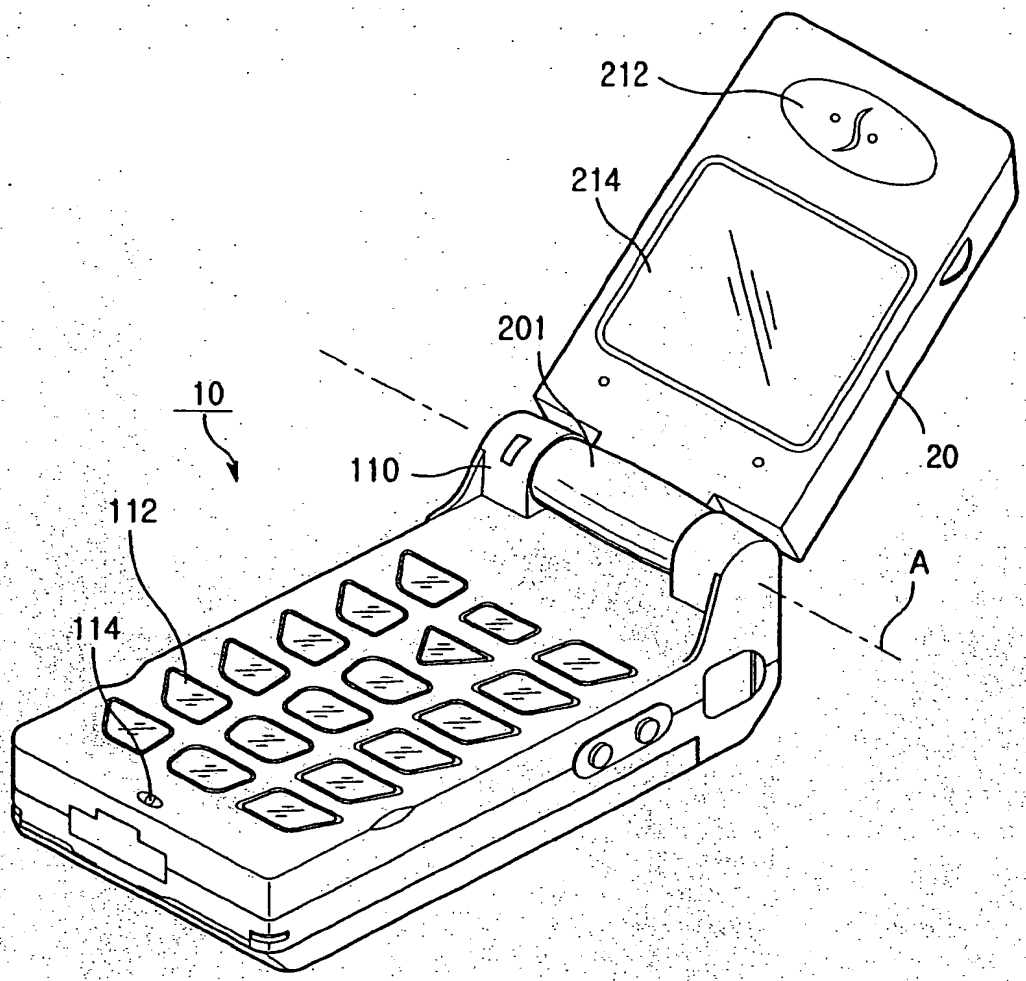


FIG.2

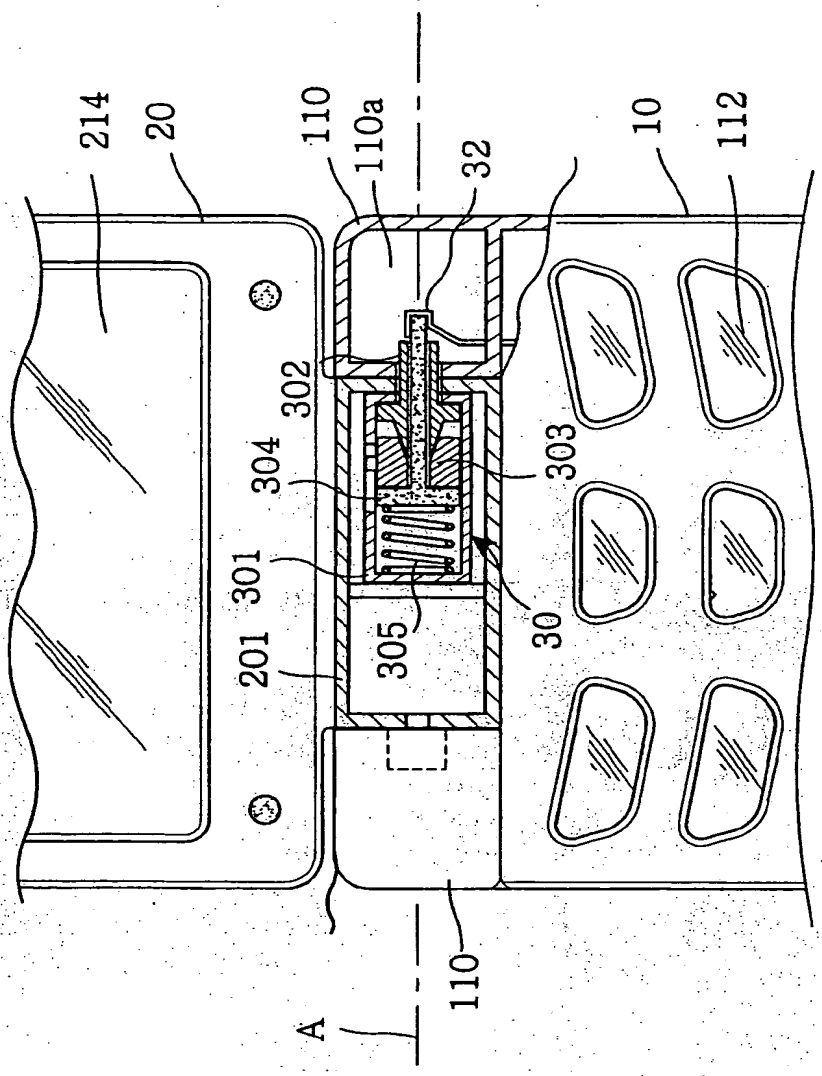


FIG.3

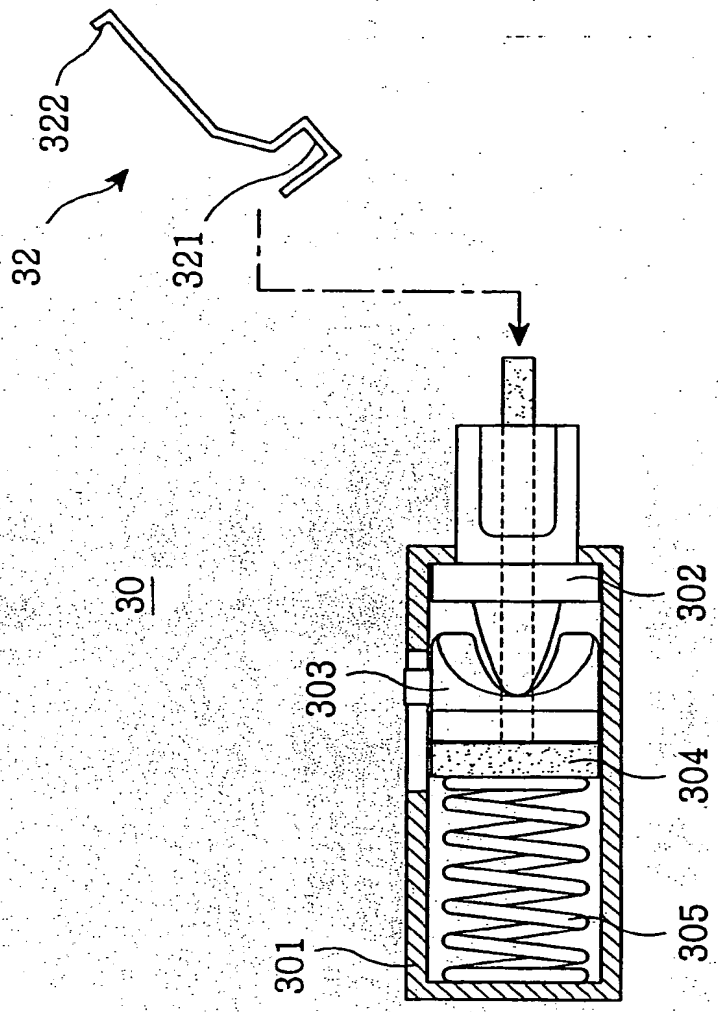


FIG.4

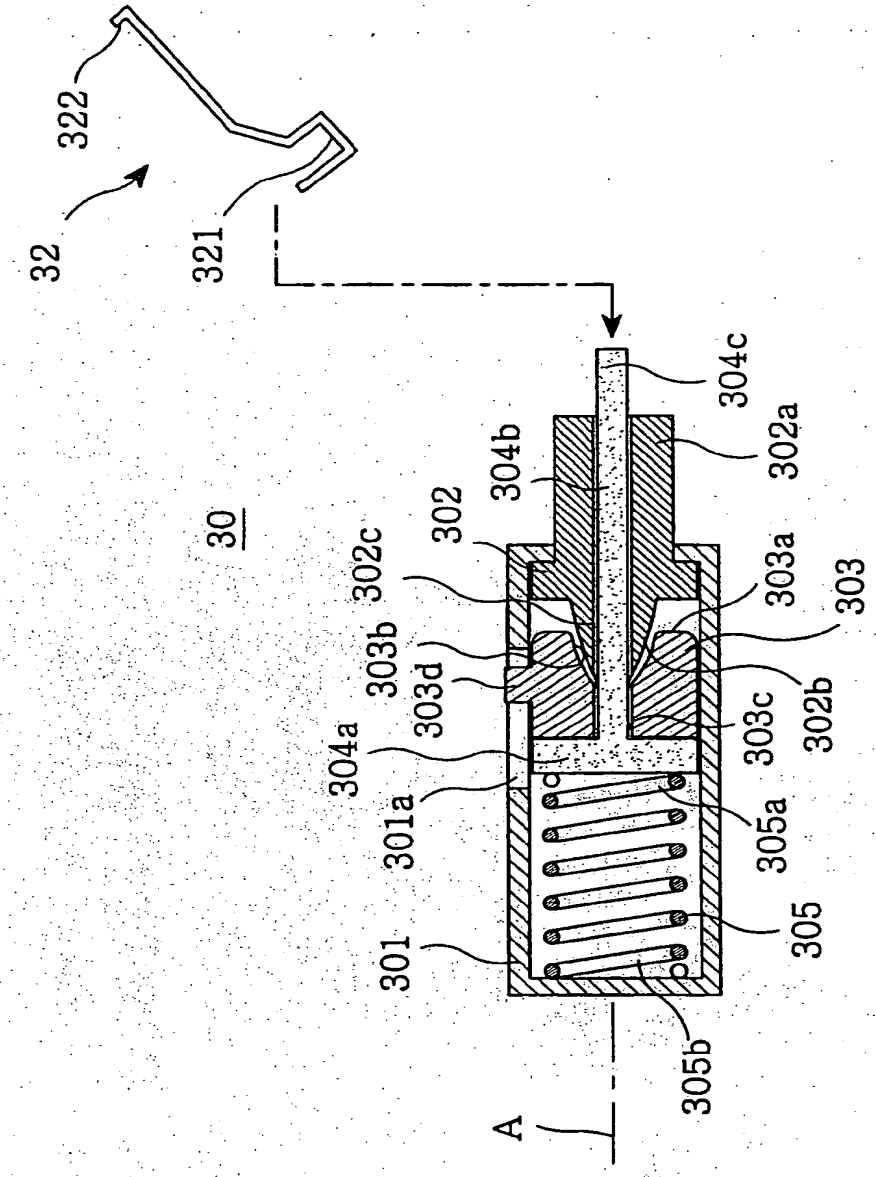


FIG.5

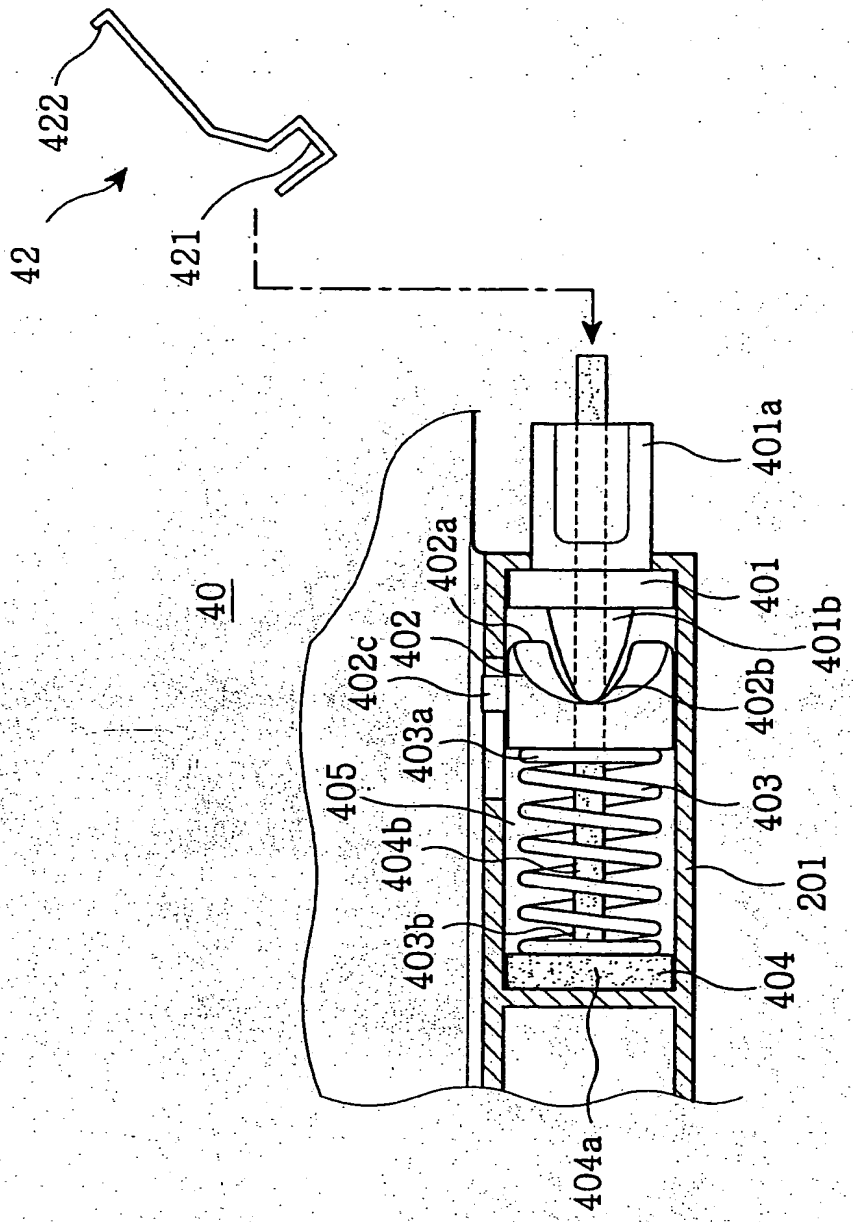


FIG.6

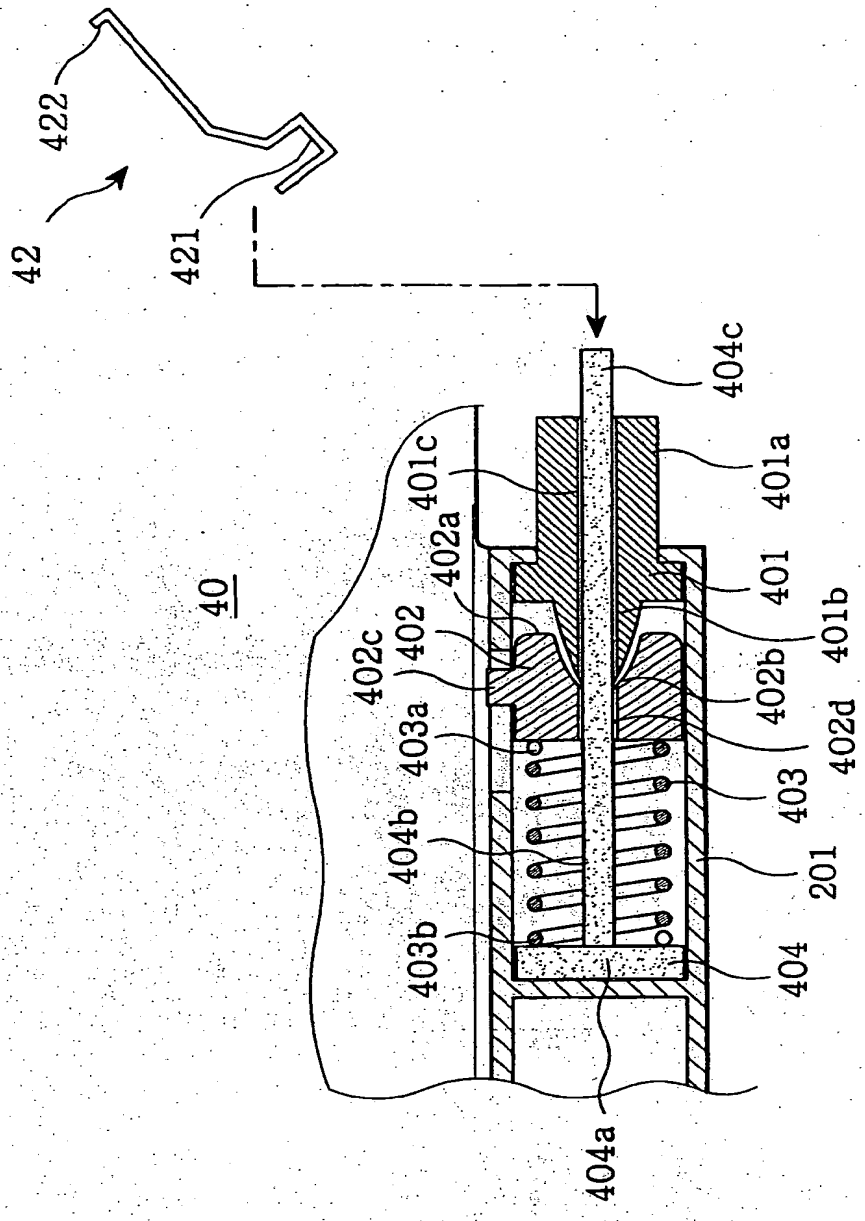
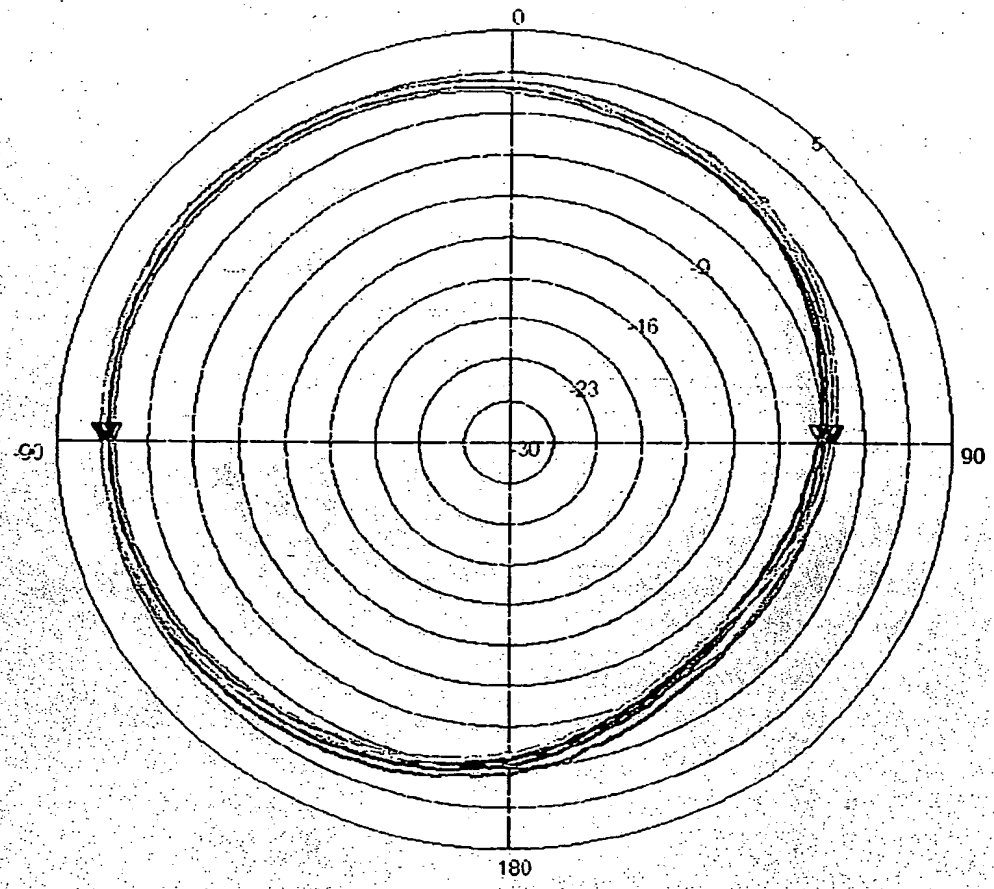
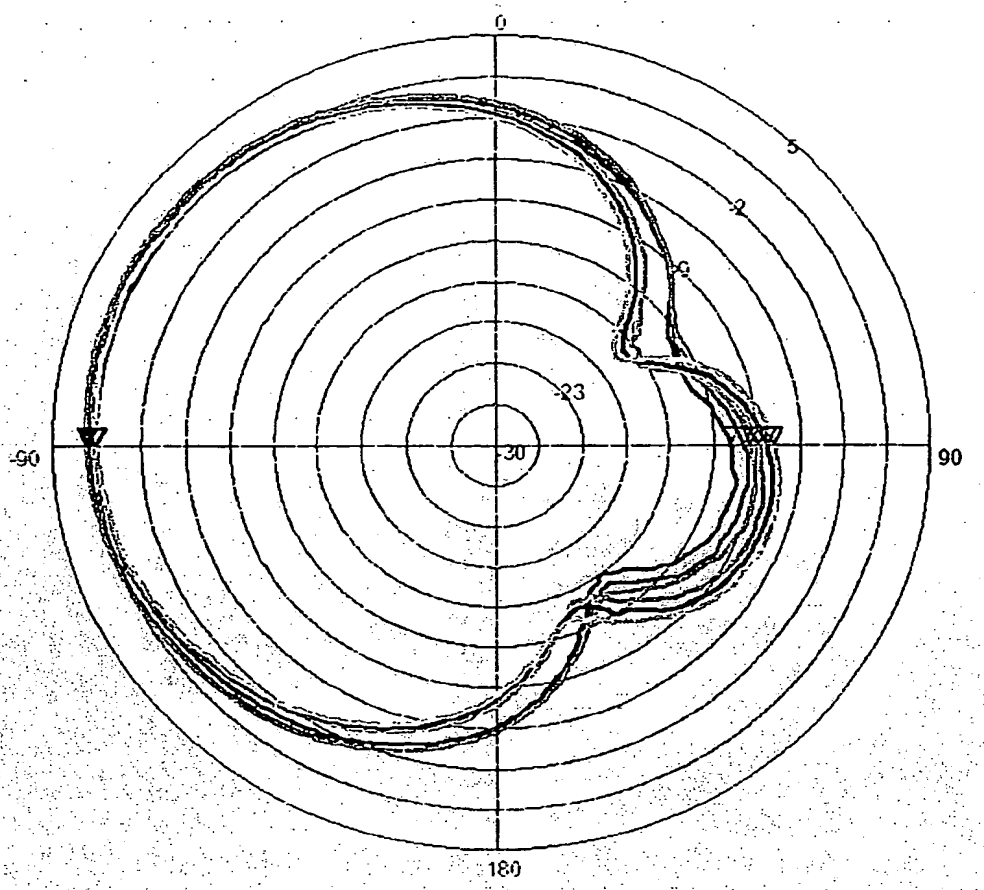


FIG.7



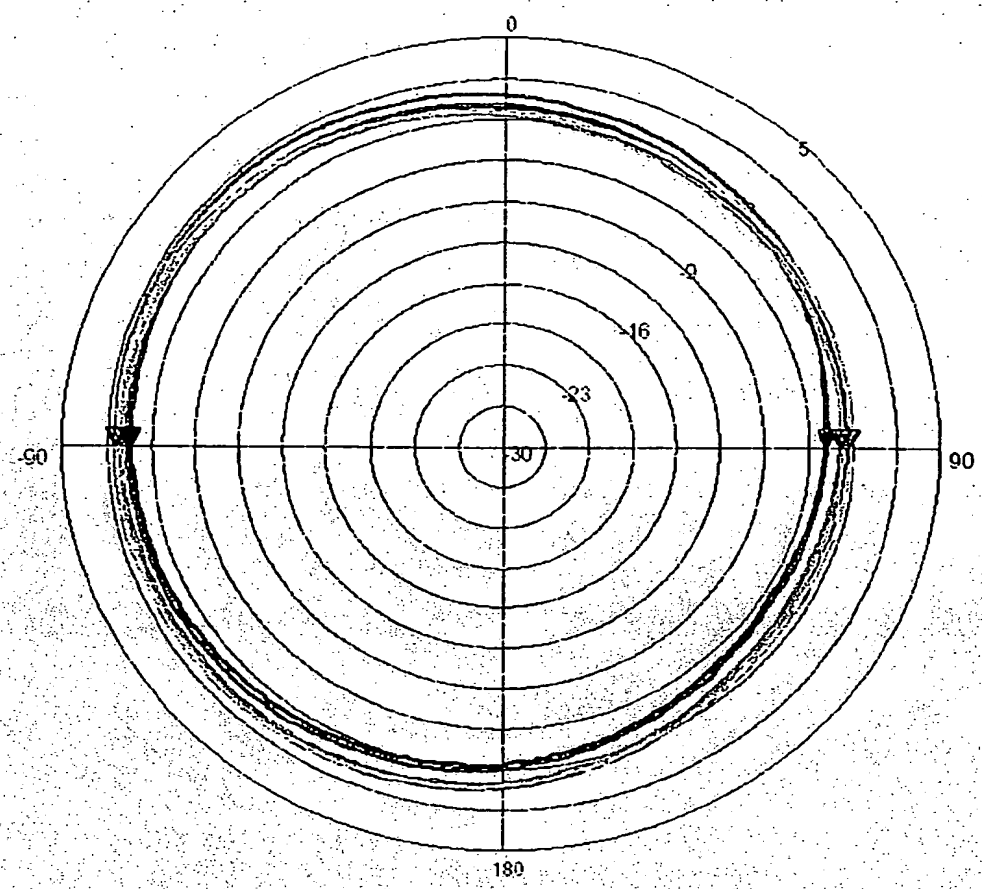
[HELICAL ANTENNA (OPEN STATUS) RADIATION PATTERN IN PCS BAND]

FIG.8A



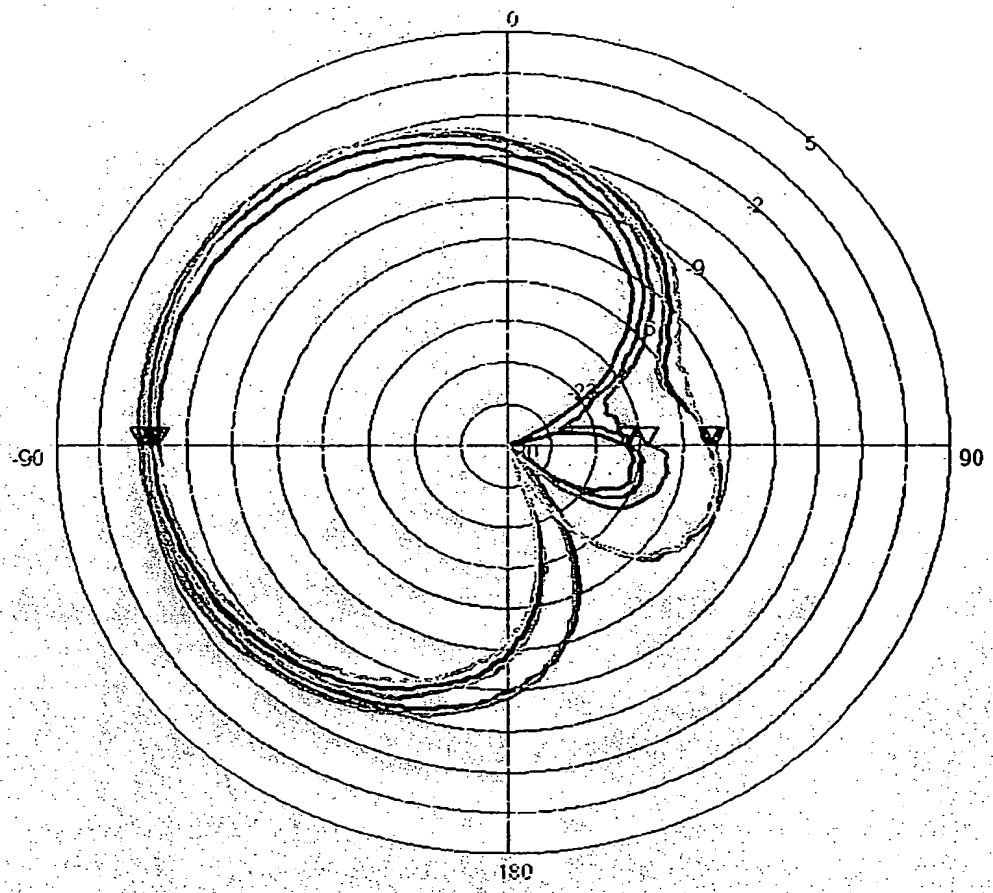
[HELICAL ANTENNA (CLOSED STATUS) RADIATION PATTERN IN PCS BAND]

FIG.8B



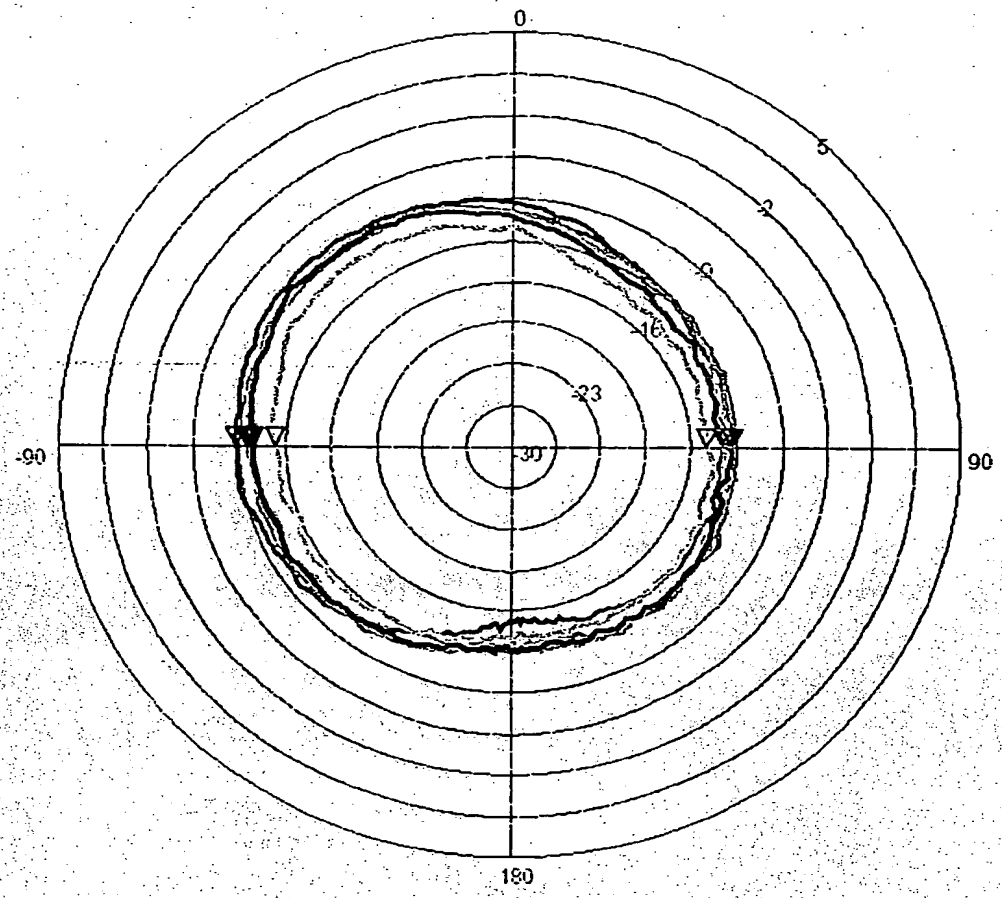
[HELICAL HINGE SPRING ANTENNA (OPEN STATUS) RADIATION PATTERN IN PCS BAND]

FIG.9A



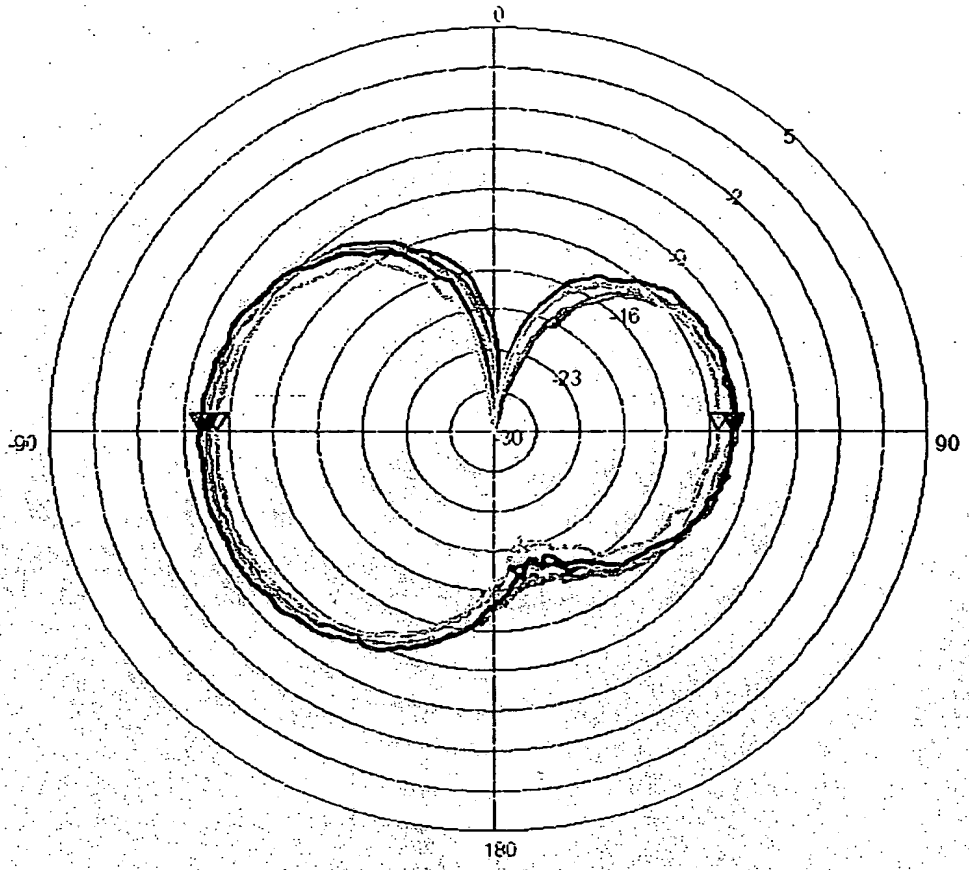
[HELICAL HINGE SPRING ANTENNA (CLOSED STATUS) RADIATION PATTERN IN PCS BAND]

FIG.9B



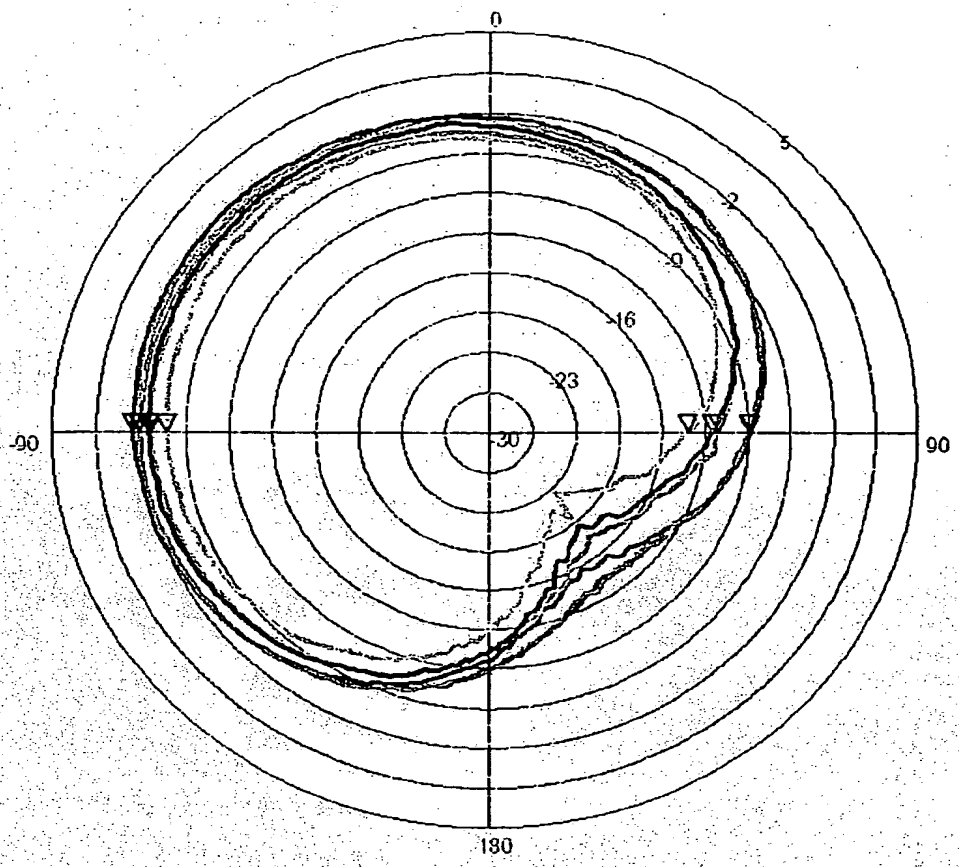
[CHIP-TYPE ANTENNA (OPEN STATUS) RADIATION PATTERN IN BLUE TOOTH BAND

FIG.10A



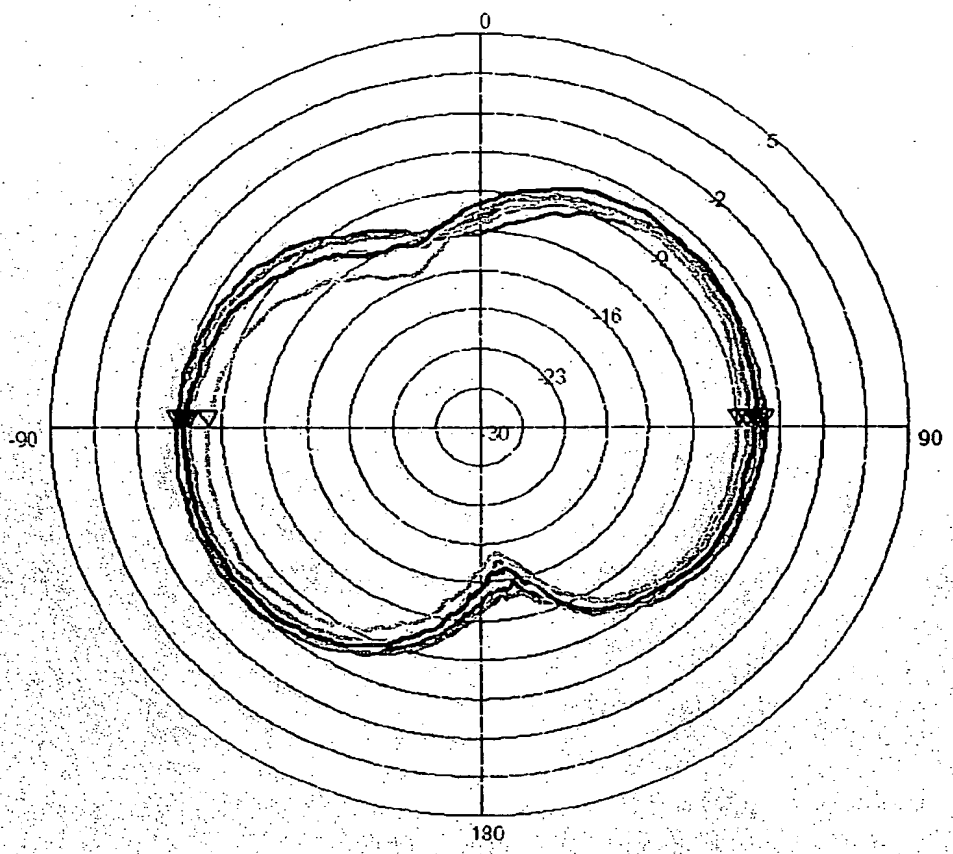
[CHIP-TYPE ANTENNA (CLOSED STATUS) RADIATION PATTERN IN BLUE TOOTH BAND

FIG.10B



[HELICAL HINGE SPRING ANTENNA (OPEN STATUS) RADIATION PATTERN IN BLUE TOOTH BAND]

FIG.11A



[HELICAL HINGE SPRING ANTENNA (CLOSED STATUS) RADIATION PATTERN IN BLUE TOOTH BAND]

FIG.11B

(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 329 981 A3

(12) EUROPEAN PATENT APPLICATION

(88) Date of publication A3:
24.09.2003 Bulletin 2003/39

(43) Date of publication A2:
23.07.2003 Bulletin 2003/30

(21) Application number: **03001202.5**

(22) Date of filing: **17.01.2003**

(51) Int Cl.[7]: **H01Q 1/24**, H01Q 1/08, H04B 1/38

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IT LI LU MC NL PT SE SI SK TR
Designated Extension States:
AL LT LV MK RO

(30) Priority: **18.01.2002 KR 2002002934**

(71) Applicant: **SAMSUNG ELECTRONICS CO., LTD.**
Suwon-City, Kyungki-do (KR)

(72) Inventor: **Kim, Young-Jin**
Paldal-gu, Suwon-city, Kyungki-do (KR)

(74) Representative: **Lang, Johannes, Dipl.-Ing. et al**
Bardehle Pagenberg Dost Altenburg Geissler Isenbruck,
Postfach 86 06 20
81633 München (DE)

(54) Antenna unit using helical hinge spring

(57) Disclosed is an antenna unit using a helical hinge spring which is used for a portable terminal including (A) a main housing, (B) a sub housing, and (C) a hinge module rotatably opening and closing the sub housing from and into the main housing and including a hinge shaft having one end attached to the main housing and the other end positioned within the sub housing and serving to interconnect the main housing and the sub housing, a hinge cam being slid by the hinge shaft and moving forward and backward, the helical hinge spring for providing a force for closely adhering the hinge shaft to the hinge cam, and a hinge housing for accommodating the hinge shaft, the hinge cam, and the helical hinge spring, the antenna unit comprising: (a) the helical hinge spring disposed in a direction of a hinge axis and serving as a helical antenna; (b) a conductive member including a contact portion disposed between the helical hinge spring and the hinge cam and closely adhered to the helical hinge spring, and a center portion extending from a center of the contact portion in the direction of the hinge axis and passing through the hinge cam and the hinge shaft; and (c) a plate spring with a first free terminal connected to the conductive member and a second free terminal connected to a power-feeding portion.

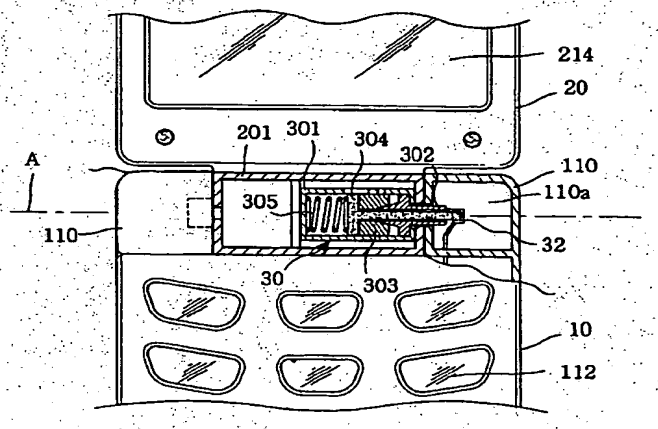


FIG.3

Printed by Jouve, 75001 PARIS (FR)

EP 1 329 981 A3

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 03 00 1202

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
A	US 6 272 356 B1 (DOLMAN RODNEY A ET AL) 7 August 2001 (2001-08-07) * the whole document *	1-12	H01Q1/24 H01Q1/08 H04B1/38
A	PATENT ABSTRACTS OF JAPAN vol. 2002, no. 02, 2 April 2002 (2002-04-02) & JP 2001 284934 A (KYOCERA CORP), 12 October 2001 (2001-10-12) * abstract *	1-12	
A	US 6 115 886 A (FUJITA ORIYA) 12 September 2000 (2000-09-12) * abstract *	1-12	
A	DE 100 06 530 A (SIEMENS AG) 16 August 2001 (2001-08-16) * abstract *	1,2,7,8	
P,A	EP 1 263 189 A (SAMSUNG ELECTRONICS CO LTD) 4 December 2002 (2002-12-04) * the whole document *	1-12	

TECHNICAL FIELDS SEARCHED (Int.Cl.7)

H01Q
H04B
H04M

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	4 August 2003	Wattiaux, V

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 03 00 1202

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

04-08-2003

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 6272356 B1	07-08-2001	NONE	
JP 2001284934 A	12-10-2001	NONE	
US 6115886 A	12-09-2000	JP 11006519 A	12-01-1999
		CN 1202567 A ,B	23-12-1998
DE 10006530 A	16-08-2001	DE 10006530 A1	16-08-2001
		WO 0161781 A1	23-08-2001
EP 1263189 A	04-12-2002	CN 1390025 A	08-01-2003
		EP 1263189 A2	04-12-2002
		JP 2003031963 A	31-01-2003
		US 2002178546 A1	05-12-2002

EPO FORM P0469

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82